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OREGON STATE HIGHWAY COMMISSION

SALEM, OREGON

BULLETIN No. 1

Oregon State Highway
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HENRY L. BOWLBY - Dec. 1, 1914 - Mar. 31, 1915
STATE HIGHWAY ENGINEER

Organization of the State Highway Commission

ENGINEERING STAFF

The engineering staff of the State Highway Commission consists of the following: State Highway Engineer, Bridge Engineer, Assistant Highway Engineers, District Engineers, Locating Engineers, Assistant Bridge Engineer, Resident Engineers, Inspectors, Draftsmen, Instrumentmen, Levelmen, Rodmen, Chainmen, Axmen, etc.

OFFICE

The office of the State Highway Engineer is located in the Capitol Building at Salem.

INSTRUCTIONS TO LOCATING ENGINEERS

Engineers in charge of location will run an angle line, keeping it as nearly at grade as may be, and take topography with sufficient care to enable a map with contours at intervals of five feet to be accurately plotted.

Topography will be taken preferably by taking cross sections with a hand level. Where the nature of the country is such that this is impracticable, it may be taken with a slope board or clinometer.

Note the size of all streams and high water marks whenever obtainable. Note also character of materials, whether earth, gravel, rock, etc., also all clearings—in fact, everything which will be of use in estimating the cost of the work.

The transit notes will be kept as shown on the sample page of transit notes furnished by the department. The magnetic course must in all cases be read and recorded.

Bearings of all courses, or lines, should be given with reference to the true meridian, and for that purpose an observation of Polaris, or of the sun, should be taken upon starting the survey, and the true course recorded in the field books. An additional observation should be taken for the correction of meridianal convergency, whenever the extent of the survey shall attain a departure of one-half degree of longitude.

Curves and bearings of tangents shall be noted on the maps and profiles in the manner shown on the samples furnished by the department. When practicable, give true bearings instead of magnetic.

When the degree of curve "D" is less than 10 degrees, the length "L" of the curve may be computed by the formula:

$$L = 100 \text{ times } \frac{\triangle}{D}$$

When "D" is 10 degrees or over, figure the length "L" as the arc of a circle, thus:

$$L = 2 \text{ pi} \times R \times \frac{\triangle}{360}$$

Grades.

Grades shall be established in even tenths, and a maximum grade of five per cent will in no case be exceeded. All angle points should be marked according to station numbers. The notes and profiles must show all culverts, drains, bridges, etc., with sizes; indicating whether existing or proposed.

The minimum radius of curvature allowed will be two hundred (200) feet. When it is impracticable to use a radius as great as two hundred (200) feet, on account of peculiar topographical features, with the consent of the State Highway Engineer, a lesser radius may be used, but in no case will this be less than 100 feet.

When a radius of less than 200 feet is used on a maximum grade, a grade compensation of one per cent for each fifty feet of reduction of radius will be used. Thus, if it is necessary to use a 100-foot radius curve on a five per cent grade, the grade line on the curve would be reduced to a three per cent grade.

Field Books.

All field books shall be properly indexed in ink, and where more than one field book is used on a survey, a complete index of all field books shall be made. The book containing this index shall be marked on the book, "Index."

The name or number of the road, or both, and the year, shall be given. All field books shall be marked with the name of the road, the year, and county, on a fly leaf; also the name of the engineer in charge of the party, the transitman, leveler, topographer, and such other data as will make the notes clear and intelligible.

All note books shall be kept according to the standard sheets sent out by the State Highway Department.

The rodman working with the leveler must keep a book in which is to be recorded the turning points. The elevations of turning points and heights of instruments are in all cases to be compared with those of the leveler, and found to be correct, before proceeding with the work.

Levels should be run in one direction and checked in the opposite. The two will be compared by means of the following formula:

$$E = C\sqrt{M}$$

Where "E" is the error between the two runnings, and "M" the distance in miles, "C" must not exceed 0.1 foot. This must hold good between adjacent benches and also between the origin and any bench.

Always establish a substantial and permanent bench at the initial point in all surveys, and note whether an assumed elevation or a sea level datum is used. B. M's. should be placed frequently, and in no instance over two thousand (2,000) feet apart.

All level notes must be checked at the end of each day's work by adding the back-sights and fore-sights and ascertaining the difference of elevation.

Field Maps.

Field maps shall be plotted in the field to a scale of 200 feet to the inch, on duplex paper, or to a scale of 100 feet to the inch whenever in the opinion of the locating engineer the larger scale is necessary.

The preliminary map must be carefully and accurately made. The skeleton of the preliminary survey shall be plotted by latitudes and

departures. This method may be checked by laying off the successive calculated courses and distances from a carefully drawn meridian, using a large protractor, not less than 12 inches in diameter.

All data obtained in the field must be placed on these maps. These maps will be sent to the office of the State Highway Engineer.

The final profiles on location will be made with a horizontal scale of four hundred (400) feet to the inch, and a vertical scale of twenty (20) feet to the inch. For the purpose of determining the final location and grade line, and for more readily balancing cuts and fills, a profile with a horizontal scale of one hundred (100) feet to the inch, and a vertical scale of ten (10) feet to the inch may be used. These working profiles must be returned to the State office with the final location profile.

A judicious use of the "Mass Diagram" should be made by the locating engineer before he is finally satisfied with his located line and grade.

Short sags should be avoided and in all cases vertical curves should be provided at grade intersections.

A diary must be kept by the locating engineer. Details of each day's work must be entered, giving dates of commencing and completing the survey. These diaries will be returned to the State office with the maps and profiles of the survey.

The engineer in charge will forward weekly progress report of work done, and all other items of interest pertaining to the work, on forms furnished for this purpose.

All maps, profiles, preliminary estimates and general records will be completed while the surveys are in progress, thus avoiding an accumulation of work at the end of the survey.

Inventory.

At the close of each month the engineer in charge will report upon a form provided for that purpose all instruments, tools and equipment in his possession, noting such as have been received during the month, and such as have been disposed of and consumed. The inventory must be written in copying ink or copying pencil, in duplicate, the original sent to the State Highway Engineer, the duplicate to the assistant engineer or division engineer under whom the work is being done.

Damage, destruction, or loss of property and equipment in his charge through carelessness or wilfulness, must be made good by the individual at fault. Engineers in immediate charge of parties are responsible for all property in their charge, and must prevent extravagance and waste in the use of supplies of all kinds furnished to them.

Requisitions.

Requisitions shall be made on the State Highway Engineer for all supplies, materials, instruments, equipment, etc., who will make purchases, or authorize the engineers to purchase locally.

Local purchases are not to be made without such authority, except in cases of absolute necessity.

Requisitions for camp supplies should be accompanied by complete inventory of supplies on hand.

All requisitions should state clearly the purpose for which items are ordered. Blanks will be furnished for this purpose by the State office.

Bills and Vouchers.

All bills and vouchers must show full detail of purchases or expenses, including dates, quantities, and unit prices, and must be fully extended, checked and certified to by the party receiving the goods, or incurring the expense. He will show clearly on the face of the bill, or attached slip, the particular account to which the item of expense should be charged.

In making up vouchers covering board or expense for members of parties, the name of each individual, with the amount incurred by each, shall be shown.

In items for board or time worked for the public, give exact dates, so that the charges may be identified.

Right-of-Way.

Right-of-way will be at least sixty (60) feet in width. Stations will be uniformly one hundred (100) feet long each, and numbered consecutively. The stakes of all lines must be numbered on the rear face, next to the transit. Mark stakes on alternate lines with distinguishing letters, A, B, C, etc. Mark stakes on located lines "L."

Ties must be secured to all township and subdivision lines whenever crossed. Give station number of intersection, angle of intersection, distance along the line to the nearest section corner, or one-quarter (¼) corner. Whenever possible, make the intersection by running through between the two corners.

On the map of the survey, do not fail to indicate which of the section corners and quarter corners have been located. If note to this effect is not made it will be assumed that the location of same has been approximated, and the corner not tied.

Section ties must be given with reference to the location center line, and wherever corners are found, ties must be so taken that the necessary right-of-way strip can be described by metes and bounds. *This is very important.* The data secured by the survey should be so complete that right-of-way deeds may be made out without any further field work. When the road is located through villages or towns, tie to corners, and secure copies of plats, with dates, certificates, etc., and send to office of State Highway Engineer.

Tie in all property and land lines, and locate all buildings, wells, fences, etc., that are found within one hundred (100) feet of the line.

Cross sections of slopes will be taken at sufficient distances on each side of the line to allow for necessary changes of line and grades.

Check all angles by needle reading, or by doubling the angle, or both.

Angle points should be indicated by station numbers.

Keep all instruments in proper condition and good adjustment.

Special Structures.

Where special structures are required, such as viaducts, large culverts or bridges, or other exceptional work, the locating engineer shall cause the ground to be surveyed and mapped to two-foot contours; scale ten (10) feet to the inch, with corresponding profile, and submit the same, accompanied by illustrative notes and such suggestions as he may think proper to add, to the State Highway Engineer, who will thereupon cause a plan to be made for such special structure. Exhibits or special maps

of this kind should include high and low water marks, character of bottom or sub-soil, and in the cases of railroad crossings, a profile of the same for five hundred (500) feet each way.

The work of the State Highway Department can be successful only through the hearty cooperation of *all* of its employes.

Faithfulness and loyalty to one's superiors must exist, not only during working hours but at all times.

Derogatory criticisms of fellow employes in this department will not be tolerated.

CORRESPONDENCE

All correspondence, reports, etc., for the State Highway Engineer shall be addressed.

"HENRY L. BOWLBY,
State Highway Engineer,
Salem, Oregon."

All official correspondence emanating from a branch office of the State Highway Commission, not addressed to the Salem office, shall be signed:

"HENRY L. BOWLBY,
State Highway Engineer.

"By .....
(Official Title.)
....."

Each letter, so far as practicable, should cover but one subject to facilitate filing.

To preserve uniformity in the "closing" of all official correspondence the term "Very Respectfully," is to be used.

PREPARING VOUCHERS

Name of payee, street address, if any, city and State address, should appear upon both sides of each voucher.

The stamps "Original," "Duplicate," or "Triplicate," should be of uniform size and appear below the heavy line at the top, and in the same part of the voucher in all cases.

Notary fees are not allowed by a ruling of the Secretary of State.

In all cases where affidavit is made by a member of a company, firm or corporation, the affiant should state his connection with the firm and the signature should be of the individual making the affidavit.

The dates on "Services Rendered," "Expenses Incurred," and "Subsistence" vouchers should show the inclusive time covered in each instance. The date on "Supplies Furnished" vouchers should be the date on which the supplies were received by the State Highway Commission.

The following voucher headings will be used to explain the nature of the claim:

I. For services rendered the State Highway Commission as (Title of Employe) from.....to.....191...., inclusive, in.....County.

II. For expenses actually and necessarily incurred while in the performance of my official duties as (Title of Employe) as per attached sub-vouchers.

III. For supplies furnished the State Highway Commission for use in (State place and to what county chargeable) as per the following statement:

IV. For subsistence furnished to party, John Jones, chief, Sam White, Will Smith, etc., as per the following statement:

Date B. D. S. (After each initial state how many
Date B. D. S. breakfasts, dinners and suppers.)
Date B. D. S.
Total number of meals furnished..... .....@.....$.....

On payrolls, two initials are to be given for each man listed. For employes having one initial only the given name is to be stated.

Where a number of invoices are attached to one claim, each invoice is to be listed on the claim setting forth the date, general nature of account and amount. Invoices are to be arranged in their chronological order.

OFFICIAL REPORTS

All official reports from resident engineers and inspectors are to be forwarded to the State Highway Engineer from district and division headquarters, where copies of same are retained for reference.

All official correspondence is to be classed under the head of "Official Reports."

Resident engineers will keep a complete diary in a McDonald's stylograph book.

Resident Engineer's *weekly* reports consist of the following:

Engineer's Weekly Report.
Contractor's Weekly Force Report.
Bridge Reports.
Copy of Diary for Week.

Resident Engineer's *monthly* reports consist of the following:

Pay Roll.
Monthly Force Reports.
Inventory.
Requisition for Supplies.
Expense Account.
Contractor's Monthly Estimate and Force Account.

Samples of all reports will be furnished all engineers.

EXPENSE ACCOUNTS

Sub-voucher blanks will be used for all cash expenditures by all engineers attached to the State Highway Commission. The following instructions for their use *must be followed carefully* to insure their allowance by the Highway Commission:

I. Make out all sub-vouchers in duplicate, using carbon sheet for that purpose.
II. Number your vouchers consecutively.
III. Be careful to state plainly the purpose of the expenditure and for whom the expenditure is made.
IV. All purchases *exceeding 50 cents* must be signed by the payee. In case of a railroad ticket, have the agent place his stamp on the voucher face in addition to his signature.
V. Use separate vouchers for separate expenditures. However, where several meals are noted, each 50 cents or less, they may be tabulated on the back of the voucher, together with date and for whom purchased.
VI. The total of the sub-vouchers attached to the monthly expense account voucher should agree with the total on the large voucher.
VII. The wording on the large voucher should be: "For expenses actually and necessarily incurred while in the performance of my official duties as (Title of Employe) as per the attached sub-vouchers."
VIII. The statement on face of the large voucher should show the date, place, nature of claim, and amount of each sub-voucher.
IX. No notary fees allowed.

REQUISITIONS

Requisitions for supplies will be made out the last of each month and mailed so as to reach this office by the first day of the succeeding month.

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Local purchases must not be made by the Engineer except when so directed or in emergencies. In such cases, cash should be paid and a sub-voucher taken for the amount of the purchase and the same included in his monthly expense account.

When ordered to purchase supplies locally, *invariably* have bills for the same made out in triplicate: keep one copy for your file and send the other two O.K.'d to this office (Division Headquarters for party having one), where the voucher will be made out and mailed to the party furnishing the order for signature and affidavit. These bills should be checked, O.K.'d and sent in, as soon as possible after the purchase.

INVENTORIES

The printed instructions on monthly inventory blanks are to be taken literally and followed carefully.

Articles lost or destroyed are to be charged to that member of the party responsible for such loss or destruction by the chief of party who is held personally responsible for State equipment.

Articles not belonging to the State are not to be listed on the inventory, but record of the same should be attached thereto.

CONTRACTOR'S MONTHLY ESTIMATE VOUCHERS

Make voucher in favor of the contractor or contracting firm, using the identical name appearing on the contract.

If the list of items on voucher does not cover some items of contract, lines 29, 30. and 31, are to be used therefore.

Enter unit prices in column marked "Prices" from schedule of rates and prices in contract. If any item not bid on in the contract is to be paid for, an agreement in writing between the contractor and the State Highway Engineer must be made previously fixing the price.

The column marked "Quantity" must contain the *grand total of all units of that classification to date of the estimate.*

The column marked "Total" is the product of column marked "Prices" and column marked "Quantity," and represents dollars and cents.

The column marked "Previous" is an *exact copy* of the column marked *"Total"* of the preceding estimate. This column is to be left blank on estimate No. 1.

The column marked *"Present"* is the algebraic difference between *"Total"* and *"Previous"* columns. This may show a negative quantity—as when re-classification or re-check of quantities gives a smaller yardage than has previously been allowed.

The item *"Material on hand"* is to be listed in one of the blank lines of the voucher. According to the contract, this item is to be paid for each month and the usual 20 per cent retained. The Resident Engineer will make an estimate *each month* of the material on hand that will eventually enter into the work covered by the contract. This includes culvert stock, cement, re-inforcing steel, etc. A statement covering these materials must be signed by the Resident Engineer and also by the contractor and attached to the estimate. The money total of the same will appear under column marked *"Total."* The *"Previous"* column entry is made from *"Total"* column of the preceding estimate and the *"Present"* column entry is obtained by subtracting *"Previous"* from *"Total."* This item also may show a negative quantity in the *"Present"* column. The Resident Engineer will make a new inventory for each estimate of *all the actual material on hand at the time the estimate is made.*

"Force Account" is entered on line No. 32. Twenty per cent is retained on this item. If ten per cent is to be added to the payroll this addition is to be made before entering in column marked *"Total,"* which column shows the total force account to date. The *"Present"* column

entry is obtained by subtracting the "*Previous*" from the "*Total.*" Be careful to attach bills for the force account to the estimate totaling the amount noted in the "*Present*" column.

Enter the totals of the three columns ("Total," "Previous," and "Present") and compute 20 per cent of each. Enter and subtract these 20 per cent items from the three totals just mentioned. The result will give the "*Total*" (the total amount of work to date); the "*Previous*" (the amount of money paid the contractor on the preceding estimate); and the "*Present*" (the amount of money the contractor will receive on this estimate.) Enter this last amount in the affidavit form attached and in the space on the back of the voucher. This is the amount due the contractor.

Use, *without fail, copying carbon* or *copying pencil* in making out these estimate vouchers.

After being certified correct by the Resident Engineer, signed by the contractor with his affidavit and approved by the Division Engineer or Assistant Highway Engineer, as the case may be, the estimate voucher is ready for approval by the State Highway Engineer.

Accuracy is absolutely essential and neatness is necessary in making up these vouchers.

The contractor in making out the affidavit must always sign his individual name, and after it the firm name.

MONTHLY FORCE REPORTS

Force Reports are to be made out and mailed to this office in duplicate on or immediately after the first of each month.

On these forms are to be shown a complete report of contractor's force converted into money, using at all times the actual rates paid by the contractor.

A separate report is to be made out for each piece of work; this must be clearly understood; for example, for each separate cut or fill, culvert, borrow pit, camp erection, dry wall, etc., and at the top of this form the station number and inclusive stations must be clearly shown for same.

The description or kind of work must appear at the top of this form on the line designated for same and should read, "Clearing and Grubbing," "Grading," "Culvert Excavation," "Camp Erection," etc., or whatever the work happens to be.

All material used by the contractor, such as lumber, coal, etc., should also be shown converted into money, as the object of this report is to show the actual and total cost of each piece of work to the contractor.

PROGRESS PROFILES

Progress profiles will be prepared monthly by each Resident Engineer.

Two blue line prints will be furnished each Resident Engineer. One of these prints will be kept by the Resident Engineer in his office, and on this print he will color the monthly progress for his own record. This progress profile, on the completion of the work, will become a part of the final record of the residency. The other print furnished will be colored monthly by each Resident Engineer at the time he makes out his monthly estimate and sent to this office with same. As soon as the progress for the current month has been taken off this profile in this office, it will be returned to the District Engineer for his information and he will mail it to the Resident Engineer.

It will be noted that at the top of these profiles there are two sets of double lines. Between the upper two lines the clearing between stations is to be shown in colors for each month and between the lower two lines the grubbing is to be shown in the same way.

Where any changes in the grade or ground line occur, the Resident Engineer should show same on these profiles, keeping them as near correct as possible.

The progress colors to be used for each month are:

January	Chrome Yellow	July	Sepia
February	Carmine	August	Emerald Green
March	Payne's Gray	September	Cobalt Blue
April	Deep Chrome	October	Vermillion
May	Prussian Blue	November	Indian Red
June	Burnt Sienna	December	Sap Green

PERSONAL RECORD CARDS

Personal record cards are to be made out for each man in the employ of the State Highway Commission and filed in the office of the State Highway Engineer.

Chiefs of parties are responsible for furnishing them for all members of their parties.

When a man leaves the employ of the Commission, or is promoted, the fact should immediately be entered on his record card, together with reason therefor.

SUB-CONTRACTOR'S FINAL ESTIMATE

Final estimates to sub-contractors will be issued only upon written request from the general contractors.

Special forms for these estimates can be obtained on requisition from the State Highway Engineer.

All final estimates must be approved by the State Highway Engineer before being delivered to the sub-contractors.

NOTIFICATION OF EMERGENCIES

Whenever there is any unusual occurence on the work under your jurisdiction you must notify the Salem office at once. If the incident is serious, telegraph. In all other cases, write a letter, giving sufficient details to make the nature of the happening clear to the head office.

ATTITUDE OF ENGINEERS

Each individual in the employ of the State Highway Commission must realize that he is the servant of the people of Oregon. The traveling public is due full consideration in all matters affecting their convenience during the construction of roads and bridges. Engineers are urged to exert every ingenuity at their command to make this inconvenience of as light a nature as possible. Courtesy at all times is recommended and expected.

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SALEM, OREGON

CONTRACTORS' ESTIMATES

REPLACING "SUB-CONTRACTOR'S FINAL ESTIMATE,"
PAGE 11, BULLETIN NO. 1

It has been our practice in the past to try to help the contractors by giving them estimates each month covering station work, that is, small portions of their whole contract. This has been done to make it easier for them to let this work in small pieces to smaller contractors.

This practice is not called for in any way by the contracts into which the State or County has entered. The privilege has been so unmercifully abused in many instances that from this date on, it will be absolutely discontinued. Hereafter the only estimates given to any contractor will be the general, partial estimate on progress of his entire contract each month.

We will not submit to him an itemized estimate by stations nor by parts of work, until the work is completed and the final is made up.

With the final estimate we will furnish the contractor an itemized estimate of the work done by stations.

Engineers working for the State Highway Commission are forbidden to give information of any kind to the contractor for the purpose of aiding him in sub-dividing the work. The contracts are let with the understanding that the successful contractor will do the work at the prices bid. They may handle the work in any manner they see fit, under the terms of the contract, and must make provision for paying their men in any manner that may seem best to them.